The Pilgrims' Progress

(Activity Model Version, with Apologies to John Bunyan)

The DRCOG Integrated Regional Model Team

A History of Our Decisions

- We wanted a new model because:
  - We polished the heck out of that ****, and it still isn't that shiny (accuracy.)
  - We got tired of saying "we can't answer that" (sensitivity.)
- Build another trip-based model or a tour/activity model?
- What tour/activity design approach should we follow?

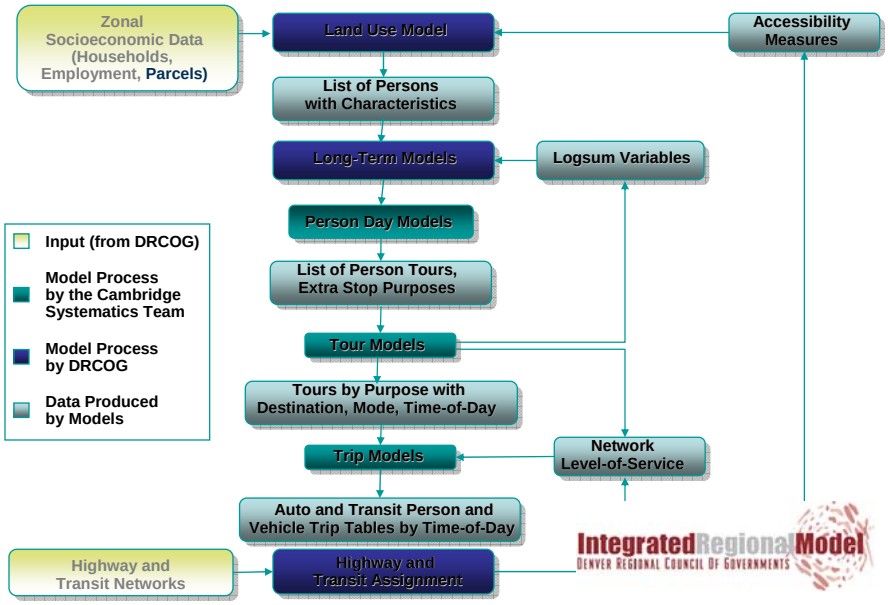
A History of Our Decisions

- How should the software be developed (and by whom?)
- How should the models be estimated (and by whom?)

Questions from the Soapbox

- Tour/activity models: widespread use without widespread knowledge?
- How black a box do you want?
- How much (and what) should you do in-house?
- Do we need to make these models more complex? Simpler? What do we sacrifice in either case?

IRM Model Structure



Project Design

- Estimation data – DRCOG leads.
- Validation year data – DRCOG leads.
- Software design and development – DRCOG leads, large consultant role.
  - integration with rest of DRCOG.
  - Flexible tool for other purposes.
  - In-house software skills.
  - Contract with local firms for specialty support.
- Choice model system design - consultant leads
- Calibration/Validation – leadership depends on budget status!

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Choice Model Design

- No explicit modeling of household interaction
- But still we have around 70 choice models
- Several categories of models:
  - Logsum generators.
  - Long-term: Usual workplace location choice model.
  - Daily activity: the DAP and associated models.
  - Location choices. the DAP and location choice models.
  - Mode choice: tour and then trip models.
- Logsums don't really "feed up from below" (no time machine model needed yet.)

Model Components

1 - Population synthesizer

1 - TransCAD network/skims

5 - Aggregate Mode/Destination Logsum

2 – Tour Mode Choice Logsum

1 - Regular Workplace Location

1 - Regular School Location

1 - Auto Availability

Model Components

5 – Intermediate Stop Logsum
1 - Daily Activity Pattern
7 - Exact Number of Tours
1 - Work Tour Destination
1 - Work-Based Subtour Generation
7 - Tour Primary Destination
7 - Tour Main Mode

Model Components

7 - Tour Time of Day
7 - Intermediate Stop Generation
7 - Intermediate Stop Location
7 - Trip Mode
7 - Trip Departure Time
1 – TransCAD Assignment/Speed Balancing
1 - Convergence Testing
1 - Output Summaries

Software Issues

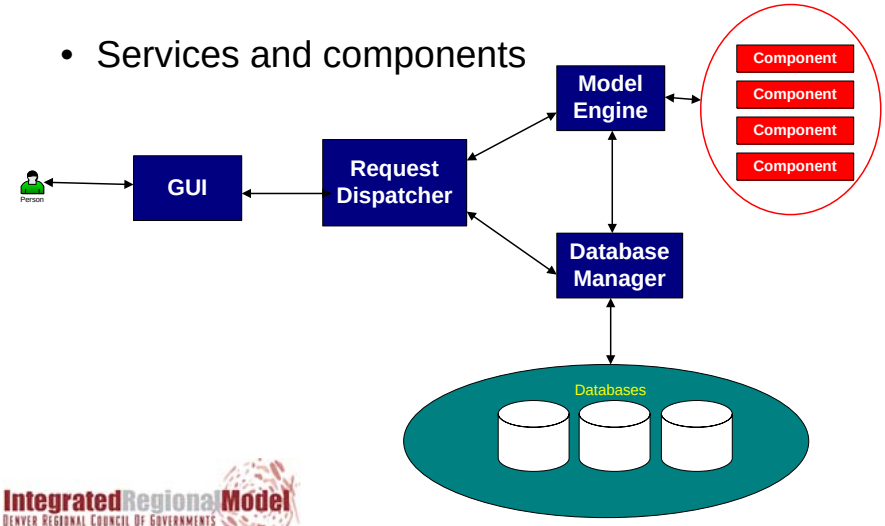
- Hard to settle on an approach (there are a million ways to do SW.)
- All efforts in US have involved considerable custom software development.
- Options:
  - Modelers do SW.
  - Modelers model, IT people do software.
  - COTS.
- Performance issues.

Software: What We Did

- TransCAD, C# and SQL Server.
- Object/service-oriented.
- Distributable/extensible.
- Usable for other models.
- Integrated with other DRCOG systems.

Approach

- Services and components



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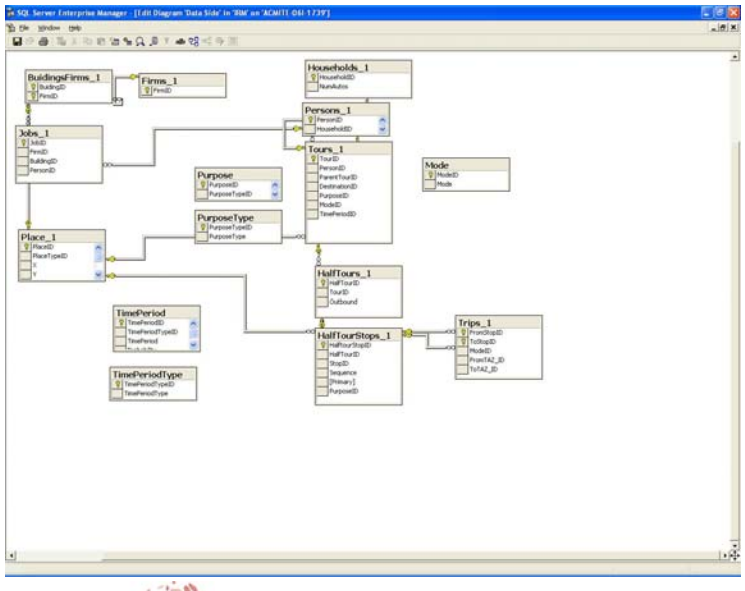

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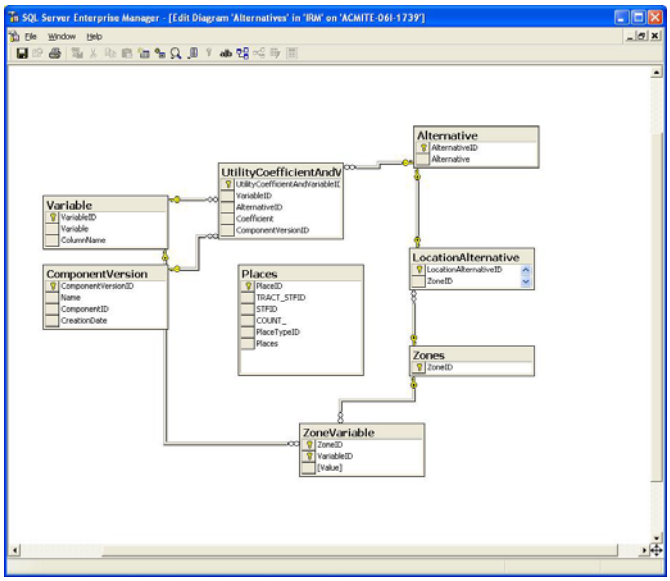

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Status

- Draft software “spine” complete.
  - Building out elements of missing functionality
  - Working on 2nd draft GUI
  - Implementing method to store/reuse scenarios
  - Finishing database
- GISDK draft complete.
- Calibration data complete, validation data in process.

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Status

- Population Synthesizer under development
- Model estimation
  - Consultant models about 75% complete.
  - DRCOG models about 50% complete.

Things We Understood Least When the Project Started

- Choice models:
  - Use of logsums
  - How location choice models work
  - How the DAP works
- Software:
  - How big the job is!

Auto Availability Model Sample

Results-11	No Car		1 Car		2 Cars		3 Cars		4+ Cars	
Retired adults per driver	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat
1 driver in HH	-3.068	-17.1			-1.969	-21.2	-3.665	-19.3	-4.456	-15.6
2 drivers in HH	-5.05	-17.8	-1.469	-13			-1.506	-18.7	-2.626	-20.2
3 drivers in HH	-5.323	-10.8	-1.962	-7.9	-0.5374	-3			-1.019	-5.3
4+ drivers in HH	-5.729	-7.9	-1.79	-4.8	-1.508	-4.6	-0.6527	-2.4		
Part-time workers per driver	-1.981	-2.9	-0.716	-3.3			0.219	1	-0.1614	-0.4
retired adults per driver	1.503	5.2	0.1482	0.7			2.87E-02	0.1	-1.058	-2.6
university students per driver	1.48	2.6	0.4936	1.4			-0.1888	-0.5	-0.831	-1.3
driving age children per driver	2.852	3.4	1.463	2.9			-0.1827	-0.4	-0.9683	-1.5
children under 5 per driver	-0.2021	-0.7	-0.5132	-2.5			-0.5844	-2.6	-1.24	-2.5
Dummy - HH Inc under $15,000/yr	3.659	15.5	1.419	6.9			-0.2115	-0.6	-1.139	-1.1
Dummy - HH Inc above $75,000/yr	-1.749	-3.4	-1.403	-8.7			0.2945	2.9	0.4995	3.3
Dummy - HH Inc not reported	1.211	5	0.1289	0.8			0.2674	1.6	0.1511	0.6

Auto Availability Model Sample

	No cars		Less cars than workers	
	Coeff	t-stat	Coeff	t-stat
Tour Mode Choice Logsum -FT worker	-0.149	-4.2	3.40E-04	0
Tour Mode Choice Logsum -PT worker	-0.4355	-4.1	-0.1017	-3.1
Tour Mode Choice Logsum –Students	0.1017	0.4	-0.1511	-1

In-House vs. Consultant

- How best to understand your model when it's done?
  - Study documentation after the model is done?
  - Closely track consultants as the project progresses?
  - Put yourself on the critical path?
- The more in-house:
  - The less black the box
  - The slower the project
  - The less you can blame the consultants for problems!

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Aphorisms so Far

- Software is hard.
- Models are complex because reality is complex.
- But strive for simplicity anyway.
- Aggregation may cause as many problems as it solves.
- Big team means more intra-team communication: this is good and bad.

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Contact Information

- Erik Sabina, esabina@drcog.org
  303-480-6789
- Tom Rossi, trossi@camsys.com
  617-354-0167